



Preventive Methods to Prevent the Development of Complications During Orthodontic Treatment

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Abstract: Relevance. A wide range of scientific research is carried out in the world to predict and identify early manifestations of caries in children during orthodontic treatment, as well as to optimize the effectiveness of diagnostic and therapeutic and preventive measures, existing diagnostic methods are already insufficient, therefore there is an urgent need for additional research methods. From these positions, it seems promising to study diagnostic and therapeutic measures aimed at improving the quality of orthodontic care for children. The development of the closest approach to the diagnosis and treatment of caries in the process of orthodontic treatment at the early stages will help to obtain a stable aesthetic outcome in the treatment of orthodontic patients, as well as to avoid relapses.

Previously, removable devices were used in 90% of cases, but now they are used only in 16% of observations. Today, 84% of patients are treated with non-removable equipment. In this regard, the problem of prevention of dental caries and periodontal diseases in the process of orthodontic treatment is particularly acute. The practical significance of the issue is determined by the high prevalence of dental caries among the population and the incidence of periodontal tissues. Incorrect orthodontic treatment also contributes to these changes [1.3.5.7.9.11.13].

Among the additional methods of diagnosing the initial forms of the carious process, modern devices that can cause fluorescence of the hard tissues of the tooth, which increases with enamel demineralization, deserve attention. It is known that fluorescence occurs if light having one wavelength hits a fluorescent material, which then emits light with a different wavelength, always shifted in the direction of the red spectrum according to the law of conservation of energy. In this regard, intact and caries-affected enamel fluoresces after absorbing light with different wavelengths.

The modern arsenal of diagnostic devices is able to effectively assess the initial stage of enamel demineralization using laser fluorescence and quantitative light-induced laser fluorescence.

To prevent such complications, various preparations with calcium and fluoride content have been proposed. However, they do not always give the desired effect, since 65-67% of the examined patients have poor oral hygiene, and local fluoridation is not effective enough due to the rapid loss of calcium fluoride crystals.

For the prevention and treatment of lesions of hard tissues of teeth, a method of deep fluoridation with typhenfluorides has been proposed, which for a long time emit fluoride in high concentration, contributing to reliable remineralization.

Currently, many fundamental aspects of prevention in the process of orthodontic treatment have not yet been fully resolved. There is no data on the use of the deep fluoridation method in orthodontics. The issues of assessing the resistance of tooth enamel and the effectiveness of remineralizing agents using mouthguards in the process of orthodontic treatment are insufficiently covered. In this regard, the urgent task is to further develop preventive measures in the process of orthodontic treatment [2.4.6.8.10.12.14.16.18].

The purpose of the study: improvement of innovative diagnostic and modern preventive measures aimed at preventing the development of caries and its complications in the orthodontic treatment of patients.

Results. To solve the tasks, 201 patients with dental anomalies aged from 7 to 15 years were examined, who were treated using removable in 22.9% of cases and non-removable equipment in 77.1% of cases, of which girls - 51.7%, boys - 48.3%. Of all the examined patients, 22.9% were treated with removable (SOT) orthodontic equipment, and 77.1% - with non-removable (NOT) orthodontic equipment.

1743 dental examinations were carried out, 201 of them primary, 1542 repeated, with calculations of CPU, OHI-S, PHP, PMA indices, evaluation of TER-test, COSRE-test; 1730 quantitative light-induced fluorescence (Qrayview C) was performed in dynamics, including before and after the use of various preventive means. 763 preventive procedures, 431 individual oral hygiene training sessions, 24 conversations, 123 children were interviewed, 201 children were surveyed. Dental examinations were carried out for 18 months in the following terms: initial examination, before the installation of fixed and non-removable orthodontic equipment, through 1, 3, 6, 9, 12, 15 and 18 months. The study was carried out in three stages: stage 1; 1743 dental examinations were carried out, 201 of them primary, 1542 repeated, with calculations of CPU, OHI-S, PHP, PMA indices, evaluation of TER test, COSRE test; 402 quantitative light-induced fluorescence (Qrayview C) was performed in dynamics, including including before and after the use of various preventive measures. Stage 2; 763 preventive procedures, 431 classes on teaching individual oral hygiene, 24 conversations, a survey of 123 children, a survey of 201 children were conducted. Stage 3; in the control subgroup A1 (n=26), teeth were examined clinically and by light-induced fluorescence in dynamics without the use of prophylactic agents. Only the usual oral hygiene was carried out. In patients of subgroup B1 (n=20), "R.O.C.S. Medical Minerals" was used twice with an interval of 14 days and with a repeated course every 6 months for the purpose of prevention. The cream was applied and fixed with the help of mouthguards. In subgroup A2 (control group, n=77), the usual oral hygiene was carried out. Preventive measures were not used. In subgroup B2 (n=78), in order to increase the functional resistance of enamel, "R.O.C.S. Medical Minerals" was used twice with an interval of 14 days and with a repeated course every 6 months. and for prevention during orthodontic treatment 2 times after 7 days every 3 months. The cream was applied and fixed with the help of mouthguards.

Preventive measures at all stages of orthodontic treatment were carried out in the dental office after professional dental cleaning. To optimize the endogenous prevention of dental caries and periodontal diseases, all patients of preventive subgroups were prescribed the mineral vitamin preparation "Oligovit" 1 tablet a day, for 1 month 1 time a year, the immunostimulating drug "Immunal" 10 drops 3 times a day for 5 weeks 1 time a year [15.17.19.21.23.24].

The obtained data were subjected to statistical processing on a personal computer using programs developed in the EXCEL package using a library of statistical functions. The differences in the mean values were considered significant at a significance level of $P < 0.05$.

Taking into account the obvious relationship between the appearance of caries, periodontal diseases and the hygienic condition of the oral cavity, before starting orthodontic treatment, all our patients were surveyed and assessed manual skills of patients, studied hygienic knowledge and skills. The analysis of the results revealed a low level of knowledge in the prevention of oral diseases and manual oral hygiene skills.

Analysis of manual oral hygiene skills showed that only 10.4% of patients were able to brush their teeth properly, which we considered good. Satisfactory manual oral hygiene skills were recorded by us in 19% of children, unsatisfactory – in 69.7% of patients on orthodontic treatment.

Taking into account the low initial level of knowledge of our patients in the issues of oral care and a large number of patients with unsatisfactory manual skills, there is a need for long-term training, educational work and motivation of children, as well as monitoring at each stage of orthodontic treatment.

Taking into account the strong relationship between the state of oral hygiene and the occurrence of dental caries and periodontal diseases, it is necessary to understand that educational and motivational work, professional dental hygiene of the oral cavity, which combines the training of manual oral hygiene techniques, compliance with the multiplicity and time of brushing teeth, as well as the consolidation of acquired skills and self-control of actions to feel the smoothness of teeth and surfaces of the orthodontic apparatus, as the most important element of the preventive complex of measures.

Analyzing the informativeness of these indices, it is necessary to note a significantly more significant reliability of the assessment by the RNR index, which makes it possible to detect plaque in the cervical and approximal areas of the teeth by segment.

At the initial dental examination, periodontal inflammation was detected in all patients, the values of the PMA index ranged from 6.72 ± 0.13 to $8.12 \pm 0.15\%$. The indicators of the PMA index, studied after a complex of therapeutic and preventive manipulations and professional oral hygiene immediately prior to the fixation of orthodontic equipment, stated an improvement in oral hygiene in all patients in comparison with the initial examination [20.22.24]. Dental education and motivation of patients, professional and individual oral hygiene, restriction of carbohydrate intake, the use of fluoride preparations are considered the basics of preventive dental programs. It should be remembered that there are numerous means of preventing carious lesions and periodontal pathology, there is a need for their clinical analysis by known informative criteria and their application taking into account the individual characteristics of the patient. The initial values of the CPI index ranged from 1.97 ± 0.14 - 2.43 ± 0.16 , i.e. low intensity of carious lesions of the teeth. The parameters of caries intensity ranged from medium (4.26 ± 0.25) to high (4.77 ± 0.24) in all our patients. Before the start of orthodontic correction, all patients had their oral cavity sanitized, after which only component P was noted in the index. The compliance of tooth enamel to acid (TER-test) at the initial examination in children with honeycomb and NOTES was within the high indicators of structural and functional resistance of enamel ($27,22 \pm 0,19$ - $32,96 \pm 0,47\%$). The effect of the quantitative light-induced fluorescence apparatus is based on a decrease in the fluorescence of hard tooth tissues during demineralization. The diagnosis of demineralization and latent carious lesions was confirmed by the use of light-induced fluorescence of the green (530nm) and red wave spectra (625nm). The transition from the green spectrum to the red spectrum was observed in 56.5% of children with SOT and in 58.1% of children with NOTES.

As can be seen from the data presented, intact enamel before the start of preventive measures was observed in 43.5% of children with SOT and in 41.9% with NOTES. The processes of enamel demineralization in the form of caries in the white spot stage were observed in 26.1% of cases with SOT and in 30.3% of cases with NOT. Superficial caries was observed in 21.74% and 16.78%, respectively. In children with SOT, medium and deep caries were recorded with the same frequency of 4.4%, respectively, whereas in children with SOT, average caries was 5.2%, and deep caries was 5.8%. As a result of laboratory methods of studying mineral metabolism in the cavity of children, the following results were obtained (Fig. 2): the pH of the oral fluid in group 1 was 6.9 ± 0.3 hydrogen units, in group 2 – 6.5 ± 0.3 hydrogen units. There were no statistically significant differences in the indicator in the groups ($P > 0.05$). This indicates the stability of this parameter of oral fluid in children, which is associated with the active work of buffer systems in the oral cavity during this period of child development. When studying the indicator of total calcium in the oral fluid, the following results were obtained: in group 1, the indicator was 1.85 ± 0.2 mmol/l, in group 2 – 1.5 ± 0.3 mmol/l. There were no statistically significant differences in the indicator in the groups ($P > 0.05$). However, a significant decrease was found in relation to the normative values (2.02-2.6 mmol/L).

The phosphorus index in the oral fluid in group 1 was 3.7 ± 0.5 mmol/l, in group 2 – 2.8 ± 0.6 mmol/l, which was statistically significant ($P < 0.05$). There was a statistically significant increase in P indicators in children with orthodontic treatment in relation to the normative values ($P < 0.05$; 0.87-1.45 mmol/l).

Conclusion. Thus, in children in both group 1 and group 2, pH values were within the normal range, Ca indicators were reduced, especially in group 2, while the P level was almost 2 times higher than normal, which was significant.

As can be seen from the above data, during the diagnosis of caries by the Qrayview C device in the comparison group, in contrast to the initial data, caries in the white spot stage was most often isolated, which proves the effectiveness of this technique in early detection of damage to the demineralization of hard tooth tissue. The obtained data increase the effectiveness of the diagnosis of caries in the early stages using the QrayviewC device by 3 times.

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